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Meeting of British and South African Associations, Cape Town, July 22nd to 29th, and Johannesburg, July 30th—Aug. 3rd

By SIR GILBERT WALKER, C.S.I., F.R.S.

The meeting of the British Association in South Africa was arranged in a manner different from that of meetings at home. In any section nearly all the time was allotted to a comparatively few representative workers to speak on broad issues in a manner intelligible to the whole section, instead of devoting most of the time to a number of highly technical papers addressed to a few specialists.

Unfortunately Mr. Stewart, the Head of the Meteorological Department of the Union was unable to attend the meeting, and there was only one professional meteorologist from England, so that only two papers were read, one by Professor J. T. Morrison (University, Cape Town) on "The General Circulation of the Atmosphere," and one by the writer of this paper on "Meteorology in Application," in which he tried to bring home the economic value of a properly organised Weather Department. Interest was aroused by a diagram showing that according to the limited information available it is possible to foreshadow the summer rainfall of South Africa outside Natal with a coefficient of 0·58; but in the absence of fully worked-out data, this result can only be regarded as provisional. In a country where a fixed routine is followed such a forecast might have small value, but in South Africa, the solution of the question whether a large or small number of cattle should be sold, or whether crops shall be grown on higher or lower portions of a farm, must be affected by impressions as to the probable

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character of the coming season, so that in years when a fairly reliable indication in general terms can be issued, it would appear to have real worth.

After the meetings of the Associations at Cape Town and Johannesburg there were informal Conferences at Salisbury with the meteorological officers of the South Rhodesian Government and at Pretoria with Mr. G. W. Cox, of the Cape Union Meteorological Service, and members of the staff of the Transvaal University College. At both places there was keen scientific interest and appreciation of the importance of meteorological data in connexion with agriculture and irrigation.

The Influence of Explosive Volcanic Eruptions on the Subsequent Pressure Distribution over Western Europe

A well-known paper by A. Defant* traces a connexion between the occurrence of violent eruptions of an explosive type and the subsequent variations in the strength of the atmospheric circulation over the North Atlantic Ocean. According to Defant's results, in the actual year of such an eruption the strength of

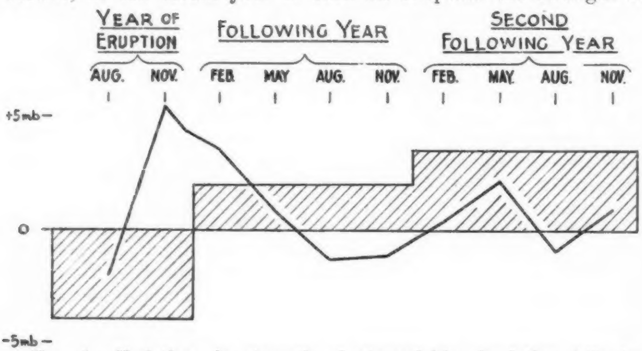

FIG. 1.—Variations in strength of atmospheric circulation following explosive eruption. Shaded area Defant; curve Ponta Delgada – Stykkisholm.

the circulation, measured by the pressure difference between low and high latitudes, is greatly decreased, while in the two following years there is a reaction in the direction of a more vigorous circulation.

If Defant's conclusions are correct, volcanic eruptions may be an important factor in the sequence of weather changes in

* Die Schwankungen der atmosphärischen Zirkulation über dem Nordatlantischen Ozean im 25-jährigen Zeitraum 1881-1905. *Geog. Ann., Stockholm*, 6, 1924, pp. 13-41.

western Europe, and it seemed that the matter was worth further investigation. A list of explosive volcanic eruptions was accordingly prepared, from 1846 to the present day, covering the period for which observations of pressure are available in Iceland. The greater part of this list was taken from a valuable compilation by K. Sapper,* in which the various eruptions were classified according to the quantity of lava and of ash emitted.

In regard to emission of ash, seven series of eruptions of the first order were found within the period :—

Date	*Volcanoes*	*Approximate amount of ash cubic km.*
1875	Askja	1
1883 August	Krakatoa	18
1886 June	Tarawera	1·5
1888	Bandai San	1·2
1888–9	Ritta Island	1·7
1902 May	St. Vincent	1·5
1902 October	St. Maria	5·4
1912 June	Katmai	1
1914	Minami Iwoshima	1

Where the month was not given, it was assumed that the eruption occurred about the middle of the year, and for Stykkisholm and Ponta Delgada the quarterly deviations of pressure from normal were taken out for the second half of the year of eruption and for the two following years, unless another eruption of the first order occurred within that period. The results are shown in table I, and the mean values of the difference Ponta Delgada minus Stykkisholm are shown in figure 1, superposed on a copy of part of an illustration given by Defant to show the variations in the strength of the atmospheric circulation. At first sight it seems that there is little agreement, a surprising result considering that four of the eruptions mentioned above were employed by Defant. It must be remembered, however, that we employed quarterly pressures for two land stations, while Defant employed annual means based ultimately for the most part on marine data. Both curves show an initial weakening of the circulation followed by an increase in intensity, but our more detailed figures suggest that the increase followed more quickly and was over sooner than appears from Defant's illustration.

The partial agreement throws no light on the reality of the phenomenon, which can only be tested statistically, from the similarity or difference of the events following each of the seven eruptions listed. In table I the average difference of pressure from normal at Stykkisholm is 4·2mb. in the quarter October

* Beiträge zur Geographie der tätigen Vulkane. *Zs. Vulkanologie, Berlin*, 3, 1916-7, pp. 150-1.

to December immediately following the eruptions. The standard deviation of the seven values from this average difference is 3·7mb., and the probable error of the difference is therefore ± 1·0mb. The difference from normal is 4·2 times its probable error, and the probability of such a ratio arising by chance in a single trial is one in 200. As, however, table I includes ten quarters, equivalent to ten trials, the probability against the result happening once by chance is reduced to 0·2, or one in twenty, which is only just significant.

We can, however, make use of the fact that there is normally very little relation between the pressure during one quarter and that during the following quarter at Stykkisholm. Hence it is legitimate to employ the differences from normal during the

TABLE I

Date of eruption	1st year Quarters				2nd year Quarters				3rd year Quarters			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
Stykkisholm												
1875	–	–	+1·3	+3·1	+ 0·1	+0·4	−0·6	+4·0	− 2·9	+3·3	+3·9	−7·7
1883	–	–	–	−6·7	− 6·4	−0·7	−2·8	−2·6	+ 2·8	−1·1	+0·7	+2·7
1886	–	–	−3·4	−2·2	− 4·1	+2·7	+2·0	+7·2	+10·9	–	–	–
1888	–	+4·7	+2·6	−9·7	+ 5·7	−4·1	+2·2	−5·2	− 5·6	−1·7	−3·1	−0·8
1902	–	–	+3·9	−3·9	−12·8	+1·7	+1·1	+0·5	− 5·3	−5·6	+0·8	−0·1
1912	–	–	+4·8	−5·7	− 8·3	−3·9	+2·8	−4·6	− 3·5	−4·0	–	–
1914	–	–	+0·8	−4·2	+ 2·8	+0·7	+4·7	+6·1	+ 0·4	+1·5	+1·6	+0·7
Mean			+1.7	−4·2	− 3·3	−0·5	+1·4	+0·8	− 0·5	−1·3	+0·8	−1·1
Ponta Delgada												
1875	–	–	−0·9	−2·2	− 0·4	+3·8	−0·4	−8·0	− 0·9	−3·6	−1·8	+3·1
1883	–	–	–	+3·8	− 0·4	−1·6	−0·2	+2·7	− 2·7	+1·3	+0·4	−1·3
1886	–	–	+1·1	+2·4	− 2·0	−2·7	+0·4	−4·0	− 3·6	–	–	–
1888	–	0·0	−0·9	+0·2	+ 4·9	+1·8	+0·7	+6·0	+ 1·6	+2·7	+2·4	+2·9
1902	–	–	−1·8	−0·2	+ 0·9	−0·9	+0·7	+2·0	+ 2·0	+1·6	−0·4	−1·6
1912	–	–	−0·2	+3·6	+ 0·4	+3·1	+0·4	+1·3	+ 0·9	+3·3	–	–
1914	–	–	+0·7	+0·2	− 2·2	−1·3	−1·1	−2·4	+ 1·1	−0·4	−1·1	−2·2
Mean			−0·3	+1·1	+ 0·2	+0·3	+0·1	−0·3	− 0·2	+0·8	−0·1	−0·2

seven quarters October to December and the seven quarters January to March immediately following the eruption as fourteen independent events. The mean difference for these fourteen events is 3·75mb., and its probable error is 0·91mb. The ratio of 4·1 to 1 would also arise by chance only once in 200 trials. It therefore seems probable that there is a real tendency for a violent explosive eruption to be followed during the following six winter months by an intensification of the Icelandic low-pressure area.

The pressure difference Ponta Delgada minus Stykkisholm may be analysed in the same way, and it is found that the average difference from normal in the quarter October to December following the seven eruptions is 5·3mb., with a

probable error of 1·4mb., the probability that such a ratio occurring once in ten trials is real is ten to one.

The excess of pressure during the quarter July to September is less certain. The average excess of 1·5mb. is only twice the probable error, and would arise by chance once in five trials. There is therefore a distinct chance that it is accidental.

The deficit of pressure generally persists into the spring quarter (April to June) in the year following the eruption, but with greatly weakened intensity. In one example, however, the deficit continued with little weakening until the end of that year, a period of 15 months. It is perhaps significant that this was the most violent eruption of all, namely, that of Krakatoa in August, 1883, when it is estimated that 18 cubic kilometres of ashes were blown into the air.

On the increase in the strength of the atmospheric circulation in the second year after eruption, shown so markedly in Defant's diagram, the verdict is less certain. The greatest ratio between average difference from normal at Stykkisholm and probable error is less than two, so that the effect might easily arise by chance.

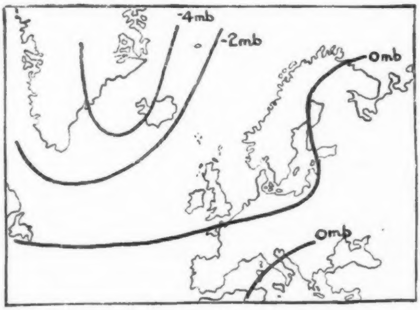

FIG. 2.—Average deviations of pressure from normal October-December following eruptions.

The average deviation of pressure from normal during the quarter October to December following each of the seven eruptions listed is shown in figure 2. It points to a decided increase in the intensity of the Icelandic low and a slight strengthening of the Azores anticyclone. The effect does not resemble very closely any of those due to "local" factors, such as variations in the strength of the Gulf Stream or in the amount of Arctic Ice; it appears to consist purely of an intensification *in situ* of the Icelandic minimum. The corresponding intensification of the Azores anticyclone is probably a secondary effect resulting from the compensation between Iceland and the Azores. The intensification of the Icelandic low is presumably to be attributed to a decrease in the upward lapse of temperature and a resulting increase in storminess.

C. E. P. BROOKS.
T. M. HUNT.

Discussions at the Meteorological Office

The subjects for discussion for the next two meetings will be :—

November 25th.—*The regeneration of a depression over the North Sea and Baltic Sea.* By Richard Schröder (Leipzig, Geophys. Inst. der Univ. Veröff Ser. 2, Band 4, Heft 2, 1929. pp. 49-116) (in German). *Opener*—Mr. S. F. Witcombe, B.Sc.

December 9th.—*A theory of auroras and magnetic storms.* By H. B. Maris and E. O. Hulburt (Physical Review, Minneapolis, Minn., 33, 1929. pp. 412-31). *Opener*—H. W. L. Absalom, B.Sc., D.I.C.

Royal Meteorological Society

The Council of the Royal Meteorological Society has awarded the Symons Gold Medal for 1930 to Dr. G. C. Simpson, F.R.S., Director of the Meteorological Office, Air Ministry. The Medal is awarded for distinguished work in connexion with meteorological science, and will be presented at the annual general meeting on January 15th, 1930.

The Council of the Royal Meteorological Society has awarded the Howard Prize for 1929 to Cadet C. E. Oehley, of S.A.T.S. *General Botha*, South Africa, for the best essay on " Solar and Lunar Halos."

Correspondence

To the Editor, *The Meteorological Magazine*

Summer Thunderstorms

If your correspondent, Mr. R. W. Green, resided in southeast England he would realise that normal cumulo-nimbus can develop at night on a scale comparable to that observed during the day. I refer, of course, to those storms which move northward from the English Channel in connexion with small depressions over the Bay of Biscay. At Cambridge on the night of July 16th this year, a thunderhead was seen to form about 4 miles to the westward at 23h. G.M.T., to tower to a great height, to form an anvil and to produce several heavy discharges to earth. This storm occurred in connexion with one of these small depressions.

On the above occasion a bright moon facilitated observation, and it seems possible that lack of sufficient illumination may be largely responsible for the small number of observations of this type of cloud at night.

C. S. Leaf.

7, Grange Road, Cambridge. October 3rd, 1929.

Smoke from Trees

With reference to Mr. Stanley Single's letter on the above subject, Mr. E. Mann, of Connaught Avenue, East Sheen, Capt.

J. A. Edgell, Assistant Hydrographer to the Navy, and Mr. S. Morris Bower of Manchester, have sent us particulars of analogous instances which support the park-keeper's statement that the apparent " smoke " was actually composed of innumerable insects. We regret that space does not permit us to publish the correspondence in full.

Double Wind Reversal

After the strong wind on Saturday, September 21st, had abated, an interesting spectacle was seen at 6.45 p.m.

Coming from south-southwest direction was a bank of fractocumulus clouds at a height of about 3,000 feet; under them were a few scattered cumulus clouds being blown from north-northeast direction about 2,000 feet high, while the smoke of a nearby brickyard chimney was being carried from a south-southwest direction.

L. W. Pye.

Council House, Cleethorpes. September 30th, 1929.

A Direct Vision Dust Counter

According to a note by C. Moran in *Tycos* for October, 1929, a new instrument called a Direct Vision Dust Counter is to be installed at various Weather Bureau Stations in the United States. The instrument consists of a microscope, an air pump, object glasses and mirrors whereby dust from a known quantity of air is collected and counted.

F. J. Whipple.

Sixteenth Century Weather

Mr. Richard Cooke of The Croft, Detling, Maidstone, has sent us the following extracts from Dr. J. C. Cox's book on Chelmsford Church :—

" The serious damage done to the church of Chelmsford by a storm in early Elizabethan days has generally escaped notice. ' The 16th of July 1565 about nine of the clocke at night, began a tempest of lightning and Thunder, with showers of hail, which continued till three of the clocke the next morning, so terrible that at Chelmsford in Essex 500 acres of corn were destroyed: the glasse windowes on the east side of the town and of the west and south sides of the Church were beaten downe with also the tiles of their houses: besides diverse barnes, chimnies and the battlements of the church which were overthrowne. (Stows Annals, 1617, page 568.) ' "

also page 63, 1580

" ' Payed to Boxford the XXVIII of Apperell for 11 boockes of prayers consarning the yerthquacke to be rede in the church Wednesdays and Frydays. VIII d.'

" Note.—An alarming earthquake occurred on April 6 1580

throughout England: it was especially severe in London. Parts of St. Paul's and the Temple Church were cast down, and two apprentices were killed at Christchurch by the fall of a stone. In addition to forms of public prayer to avert God's wrath, a form was also issued to be used by householders with their whole family every evening before going to bed."

The Appearance of the Sun and Moon through a Cloud

In the *Meteorological Magazine* for January, 1929, Mr. C. K. M. Douglas put forward the suggestion that the appearance of the disc of the sun or moon seen through a cloud depends on whether the cloud consists of ice-crystals or water-drops, believing that clouds composed of ice-crystals may give a blurred appearance to the edges of the disc and that clouds composed of water-drops give a sharp appearance, but never a blurred one.

This suggestion seemed one worthy of consideration and one that could readily be put to the test of observation. With this end in view I asked that the Staff of the Meteorological Office at Holyhead should take observations of the sun or moon through clouds whenever this was possible. The request was readily granted and the table hereunder shows the results of the survey for the period March 1st, 1929, to June 30th, 1929. In this table only those occasions when Holyhead reported one type of cloud are taken. In addition, occasions when halos or coronas were reported are treated first, in conjunction with all other occasions, and second, separately.

Cloud type	All occasions			Halo present			Corona present		
	Blurred	Sharp	Very Sharp	Blurred	Sharp	Very Sharp	Blurred	Sharp	Very Sharp
Cirrus	0	6	4	0	0	0	0	0	0
Cirro-stratus	0	26	9	0	14	2	0	0	1
Cirro-cumulus	0	2	0	0	0	0	0	2	0
Alto-stratus	8	2	0	0	0	0	0	0	0
Alto-cumulus	0	4	9	0	0	0	0	0	6
False cirrus	0	1	0	0	0	0	0	0	0
Stratus / Fracto-stratus / Strato-cumulus ...	0	7	4	0	0	0	0	0	0

The table may be allowed to speak for itself. It is to be noticed, however, that alto-stratus cloud alone gives any blurring and this supports Douglas' contention that only ice-crystal clouds are adequate to blur. The point that seems to require more emphasis than was given in the original letter is that

thickness is entirely necessary. This is shown by the fact that of 47 cases of cloud of cirrus type, that is to say, of ice structure but thin, none gave any blurring at all.

WILLIAM H. PICK.

33, Brunswick Square, London, W.C.1. July 6th, 1929.

NOTES AND QUERIES

The Level of Underground Water in the Thames Valley.

In the May number of the *Meteorological Magazine* some details were given with regard to the records of the level of underground water at Kew Observatory. It was mentioned that on May 5th, 1929, the minimum reading was 178cm. above mean sea level. The level of the water has fallen month by month since then. The lowest readings for each fortnight are given in the following list :—

Date	Days after new moon	Height above M.S.L. (cm.)	Date	Days after full moon	Height above M.S.L. (cm.)
May 7th	—2	176·6	May 25th	2	173·8
June 8th	1	170·8	June 24th	2	170·2
July 7th	1	165·3	July 24th	3	168·4
Aug. 6th	1	162·4	Aug. 21st	1	163·8
Sept. 4th	2	161·3	Sept. 19th	1	167·3
Oct. 5th	3	161·0			
Nov. 4th	3	154·4			

It will be noticed that the water is generally lowest on the day after new moon. (In May, however, the first minimum preceded the new moon by two days.) There is a rapid rise (averaging 13cm.) in the week after the new moon minimum. The secondary minimum which occurs two days after full moon is followed by a much smaller rise. In June and July the rise was insignificant, only half a centimetre, and in October the secondary minimum did not occur.

Mr. Bilham's analysis* of the records for the summers of the years 1914 and 1915 gave no indication of any striking contrast between the movements of water level in the two halves of a lunar month. He made the two minima fall on the day of new moon and one day after full moon. Mr. Bilham had at his disposal the records of the level of the river at Richmond Lock, and he found that the level at high tide was highest two days after full moon, lowest five days before new moon. Presumably it is because the gravel is being gradually drained during the week of low water in the river that the underground water reaches its lowest stage about the time of new moon. Probably the neap tides of the second half of each lunar month have been exceptionally weak this year.

* *London, Q.J.R. Meteor. Soc.* 44 (1918), *p.* 183.

The notable drop in the water level in October after the end of the drought was unexpected. Whither it is to be explained by some peculiarity of the tides at this season or by the regulation of the flow of the river over Richmond Lock I do not know.

The only periods since the beginning of the record in 1914 with the level below 161cm. above M.S.L. were a few days in September and December, 1921, and a fortnight in January, 1922, when 157cm. was registered.

As to the origin of the underground water an inquiry by Mr. H. G. Lloyd, of the Engineer's Department of the London County Council, led to his taking a sample on June 3rd. The sample was tested by Mr. J. H. Coste, who reported that "The examination of this water gives no indication of the possible flow of water from the river. It is of the general character of water in the Thames Valley." The assumption that the water is continually flowing down stream and is merely dammed back by the tide in the lower river is therefore justified.

F. J. W. WHIPPLE.

A Peculiarity in the Variation of Distribution of the Annual Rainfall

In the course of another investigation it became necessary to find out whether the 35-year means of monthly values of rainfall varied too much for a certain use. Dr. Glasspoole has shown that, in general, the constancy of such means of annual values can be relied upon quite closely.

The variation of the monthly means was found quite large, as shown in table I for Spalding, Lincolnshire, using percentages of the annual means for various 35-year stretches.

TABLE I

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Max.	8·4	6·7	7·7	7·3	8·4	10·0	11·0	11·3	9·6	11·1	9·0	10·0
Min.	6·6	5·6	5·6	5·7	7·0	7·4	9·7	9·8	7·3	9·8	8·2	6·4
Ratio	1·27	1·20	1·38	1·28	1·20	1·35	1·14	1·15	1·32	1·13	1·10	1·56

It was noticed in the case of this station that there was a tendency for months separated by half-year intervals to vary oppositely. This relationship was striking enough that it was felt worth while to compute correlation coefficients to express it, from such stations as have long trustworthy records. The best way to test the relationship appeared to be to compare the rainfall of January in each period, expressed as a percentage

of the annual total, with the corresponding figure for July, that of February with August, and so on. From the six sets of figures so obtained one general correlation coefficient for the station was computed. To get sufficient independent points 20-year means were formed. With a rainfall record of 100 years this gave five sets of six pairs of months, or 30 pairs. Where these intervals left remainders of less than 20 years in the recent data, these remainders if greater than ten years were used as additional points. It was assumed that means of different months are independent. This is not quite true, for if one month gains in its percentage of the annual, the others must, on the average, lose a little.

The stations used, the length of the record of each, and the coefficients for the six pairs of months formed as described above are given in table II. In Spalding, for example, there were 30 such pairs used in computing r.

TABLE II

Station	*Years of record*	r
Spalding, Lincolnshire	1829-1928	—0·60
Armagh, Ireland	1854-1928	—0·46
Edinburgh (some early data missing)	1770-1928	—0·40
Greenwich	1815-1928	—0·22
Exeter, Devonshire	1817-1928	—0·04
Start Point, Orkneys	1814-1928	+ 0·04

Certain pairs of months exhibited the negative correlation much more strongly than others. Table III shows the coefficients for each pair, computed from all stations except Start Point, which varied entirely differently.

TABLE III

Month Pair	Jan. July	Feb. Aug.	March Sept.	April Oct.	May Nov.	June Dec.
r	−0·34	+0·03	−0·59	−0·47	−0·01	−0·23

For the five stations there were 162 pairs of months used, giving $r = -0{\cdot}30 \pm 0{\cdot}048$.

The Orkney coefficient would have been —0·15, had the first 20 years been excluded. This part of the record is so far below normal that serious doubt is cast on its accuracy. Combined with the distance of the station from the others there seems evidence sufficient to warrant its exclusion from the mean.

Though it is probably merely an accidental coincidence, it should be noted that the correlation factors become less negative progressively as we go north or south of Spalding.

Many explanations offer themselves for the phenomenon, but at present it is perhaps best to regard it merely as an interesting coincidence which may disappear with longer records. Should it persist, it will be time later to look for causes.

DINSMORE ALTER.

Frequency of Waterspouts in British Waters

Tornadoes and waterspouts are generally looked upon as belonging to or associated with weather phenomena peculiar to the tropical regions. Recent meteorological investigations have tended towards the view that both tornadoes and waterspouts occur under conditions present during or simulating those of a line squall. Should this view be the correct one it is rather striking that so few tornadoes or waterspouts should be reported in the British Isles where line squalls are not infrequent. It may be that tornadoes do occur frequently but on a minor scale in comparison with those of lower latitudes and in sparsely populated localities. With reference to waterspouts, they occur at sea, and have less chance of being observed. In order to arrive at an approximation as to the frequency of waterspouts alone round the British Isles I have been able to trace 16 occurrences since 1920 in the daily press and have obtained two other cases from a collection being made by Mr. Giblett. These 18 cases do not necessarily include all the cases which have occurred during daylight nor even all those which may have been reported in the press. Two of these were observed off the Lancashire coast, four in the North Sea and twelve in the English Channel and the Thames Estuary.

None occurred in the period from January to March in any year, the months of July, August and September accounted for ten, while there were two in each of April, May and October, and one in June and November.

Brief details of the above 16 waterspouts, taken from the daily press are given below and are arranged in order of occurrence :—

1. *Daily Mail*, July 27th, 1920. Observed on July 26th, 1920, off the Kent coast.
2. *Daily Mail*, July 29th, 1920. Observed during the previous 2 or 3 days off the Kent coast, on the North Sea and off the southern coast of France.
3. *Daily Mail*, August 30th, 1920. Observed on the evening of August 29th, 1920, $1\frac{1}{4}$ miles from Blackpool. Storms raged in parts of Blackpool at the same time while other parts of the town escaped.
4. *Daily Mail*, September 8th, 1922. Observed on September 7th, 1922, off the Kent coast between Deal and South Foreland. Five appeared one after another within 75 minutes, the first just after 10 a.m. Each successive one appeared greater than the previous one.
5. *Daily Mail*, July 19th, 1923. Observed on July 18th, 1923, about noon. Two seen from beach at Herne Bay, Kent.
6. *Daily Mail*, August 20th, 1923. Observed on August 18th,

1923, 2 miles out at sea from Brighton; estimated height 700-1,000ft.

7. *Daily Mail*, September 6th, 1923. Observed on September 1st, 1923, over the North Sea. The weather had previously been stormy but was fair at time of occurrence. Caused a wave 40ft. high.
8. *Daily Mail*, May 8th, 1925. Observed on May 7th, 1925, during thunderstorm near Goodwin Sands Lightships. It was travelling in a north-easterly direction.
9. *Morning Post*, April 22nd, 1926. Observed on April 21st, 1926, off Folkestone.
10. *Daily Telegraph*, October 28th, 1926. Observed over North Sea and reported by trawler skipper on arrival at South Shields on October 27th, 1926. Velocity estimated at 40m.p.h. and height as 1,200-1,400ft. As the spout approached the trawler the wind dropped and the spout altered course.
11. *Evening News*, November 6th, 1926. Observed off Sandgate, after thunderclap, on November 6th, 1926. It was followed by whirlwind.
12. *Daily Mail*, September 13th, 1927. Observed on September 11th, 1927, approaching Bootle from north-west.
13. *Morning Post*, April 14th, 1928. Observed on April 13th, 1928, between the Islands of Alderney and Guernsey by a pilot of Imperial Airways Ltd., who described it as being suspended from the flat base of a huge black cloud
14. *Daily Mail*, June 12th, 1928. Five waterspouts observed at Hayling Island and Isle of Wight on June 11th, 1928. First seen near Nab Tower and travelled towards Spithead.
15. *Daily Chronicle*, August 23rd, 1928. Observed off Woolacombe on August 22nd, 1928. Whirling mass of water from sea to clouds a few minutes after a thundershower—the whirling mass raced from Baggy Point to Morte Point—struck the cliffs—ended in a huge wave.
16. *Daily Mail*, September 26th, 1928. Observed about 4½ miles off Deal on September 25th, 1928. Reported as an immense waterspout with a large rainbow circling its conical shaped top. Remarkable background formed by heavy rolling clouds in which the sun was setting; spout lasted for about 10 minutes.

Of the two other cases mentioned above, one was observed at 4.45 p.m. on August 13th, 1928, off the Dorset coast, and the other on October 6th, 1928, south of Cattewater.

J. CRICHTON.

[For descriptions of other waterspouts that have been observed round the British Isles, see the *Meteorological Magazine*, Vols. 55-63, 1920-8.—Ed., *M.M.*]

Ink Feed for Instrument Pens of the Crowquill Type

We have received from the Meteorological Office, Heliopolis, particulars of a method suggested by Mr. C. Vaughan-Starr, and adopted at Amman, Trans-Jordan, for ensuring that the crowquill pens fitted to the pressure tube anemograph are kept adequately supplied with ink. A Dines anemograph recording velocity and direction was erected at Amman in 1928 and, at first, great difficulty was experienced in obtaining satisfactory records. The flow of ink from the pens was spasmodic, and loss of record occurred through the ink failing to reach the extreme tips of the recording pens, which were of the usual crowquill type. The problem was finally solved by inserting a second crowquill nib inside the nib which actually traced the record. The point of the second nib came within one-tenth millimetre of the recording point and its function was somewhat similar to that of the ordinary feed fitted to fountain pens. By capillary action between the inner and outer pens, a good supply of ink was maintained at the point of the recording pen and a uniform flow of ink was obtained. Before fitting the feed nib, it was thoroughly cleaned free of grease, and the cylindrical portion was squeezed so as to make one edge of its split overlap the other, and the point of the feed nib was then pushed through the cylindrical part of the writing nib, keeping the two splits of the two nibs in alignment. With this arrangement good records were obtained for days at a time without attention to the pens.

The requirements of the pressure tube anemographs are exceptionally severe so far as the recording pens are concerned, and custodians of these instruments will welcome the description of a method which appears to have given very satisfactory results under unusually trying conditions.

Mr. Starr has also reported that improved recording has been obtained by rubbing the charts with a piece of muslin dipped in French chalk. This preparation counteracts any slight greasiness tending to prevent the ink flowing freely on to the paper.

Experience at home stations has shown that slight greasiness of the pen is the main trouble in obtaining good marking. The practice has been to advise custodians to prepare new pens for anemographs by holding them for a moment in the flame of a match and then dipping the points in the recording ink while still hot. This procedure, followed if necessary by pressure on the points to open them out slightly, usually suffices to make the pen work well. Mr. E. S. Tunstall has recently informed us that the same result can be obtained by dipping new pens in a weak solution of sulphuric acid and then carefully washing off the acid.

The Chilean Meteorological Service

The Chilean Government announces the reorganisation of meteorological services of the country under the name of "Chilean Weather Office," which will be a branch of the Ministry of Marine. The old "Central Meteorological and Geophysical Institute" will be incorporated in the new service.

A regular series of publications will be issued, including a daily weather bulletin, while observations and forecasts will be broadcast daily, and in addition full meteorological information will be given when required for international flights.

Reviews

Die Regeneration einer Zyklone über Nord-und Ostsee. By Richard Schröder, Leipzig. Veröff. Geoph. Inst. Univ. 2nd Series. Vol. iv, Part 2. pp. 49-116. 1929.

This publication is based on a very detailed examination of the synoptic data for the period September 29th to October 3rd, 1912, carried out on the lines of the Bergen School. Observations from over 1,000 stations were used, including autographic records from about 150 stations, and also upper air data on October 2nd and 3rd. A number of barograms and thermograms are reproduced. It would have been an improvement to have included some anemometer records, but these were evidently scarce on the Continent in 1912.

The problem dealt with is the important one of the "regeneration" of a cyclonic depression. The simplest type of depression has a period of deepening of about one to three days, followed by a period of dissolution of about two to five days, after the warm sector has been displaced. Some depressions, however, have a much longer life history, owing to one or more "regenerations." The example discussed in the paper had two such "regenerations." The first of these took place over England and the southern North Sea between September 30th and October 1st, and was due to a new centre forming further south and amalgamating with the old centre. This is a common development whose real character may escape detection unless the network of observations is fairly close. The second regeneration was of a less common type, and took place over southern Sweden and the Baltic during the night of October 1st. It was due to a fresh burst of polar air from the north, much colder than the maritime polar air surrounding the old depression. The air circulation round a typical old depression is of a type not easily penetrated by new masses of air from outside, except in a shallow layer near the ground, where the influence of surface friction is large. In the present instance the cold current cut across the isobars into the centre of the depression, and formed a large temperature discontinuity, where formerly there had been none.

At one place the temperature fell 7°C. (13°F.) in about an hour. The regeneration of the depression followed at once, and pressure at the centre dropped from 980 to 965mb. during the night of October 1st. The new warm sector was itself displaced within 24 hours, and the depression then filled up. It is important to know to what extent the movement across the isobars was confined to the lower layers under the influence of surface friction. Unfortunately there were no upper air observations north of the centre, so that the vital point remains undetermined. The sounding balloon observations were all 500 miles or more from the centre on its southern side.

The latter part of the paper is devoted to a detailed discussion of the supply of energy. Reasons are given for supposing that the increased kinetic energy during the regeneration was supplied by the displacement of the warmer by the colder air mass, according to Margules's well-known scheme, but in the absence of the necessary upper air data many assumptions have to be made. This part of the paper is open to criticism in several respects.

The work under review gives us probably the most detailed investigation yet made of a cyclonic depression, but it might with advantage have been shorter. One is impressed by the fact that even the completest possible examination of a well-chosen case leaves us far short of that knowledge of the life history of a depression in three dimensions, required to form the basis of any important advance in synoptic meteorology.

C. K. M. Douglas.

Spitsbergen Papers, Volume 2. Scientific Results of the Second and Third Oxford University Expeditions to Spitsbergen in 1923 and 1924. Size 10×7in. *Illus.* H. Milford, Oxford University Press, London, 1929. 30s. net.

This volume consists of a series of 25 excerpts from various scientific periodicals, such as the *Geographical Journal* and the *Quarterly Journal of the Geological Society*, bound together in one volume with a short preface. The sources of the papers are not all of a uniform size, and the appearance of the volume is in consequence somewhat ragged, but it will be a great convenience to students of the Arctic to have all the various papers collected in this way. The book is thus a weighty argument in favour of the policy, advocated by Mr. J. F. Pownall in his book on "Organised Publication" (London, 1926), of a standard size for scientific publications to replace the innumerable shapes and sizes at present collected under the general term "octavo."

The series contains three papers definitely dealing with the meteorological results. Capt. F. Tymms describes the general results of the meteorological observations in an appendix to a

paper by Mr. F. G. Binney in the *Geographical Journal*. Associated with this are two very interesting papers by the same author on "Aerial Navigation in the Arctic" and "Aerial Survey." The second paper, No. 7 in the list of contents, is a summary reprinted from the *Meteorological Magazine*, vol. 60, p. 187. The third meteorological paper is by Mr. K. S. Sandford, entitled: "Summer in North-East Land, 1924: the Climate and Surface Changes," and is from the *Geographical Journal*. It contains a remarkable study of the surface wind directions over the ice sheet in relation to changes of pressure, the general winds, except those associated with very deep depressions, being modified or "cushioned off" by the air over the cap of ice. The wind system is therefore described as "a type of 'intermittent glacial anticyclone'." Great interest attaches also to the discovery on August 8th of numerous living insects in North-East Land, which were subsequently shown to have been carried by the wind a distance of at least 800 miles from the forest belt of northern Europe.

The Climate of the Netherlands Indies. Vol. II, Part 2, *Java and Madoera*, and Part 3, *The Archipelago without Sumatra and Java.* By C. Braak. K. Magn. Meteor. Obs., Batavia, Verh. No. 8. Size 11 × 7½in. English Summaries. *Illus.*, Batavia, 1928.

In previous numbers of the *Meteorological Magazine* we have noticed the first or general volume of *The Climate of the Netherlands Indies* and the first part of the second volume, dealing with Sumatra. The second part, Java and Madoera, surpasses even the high standard of the earlier sections, and Dr. Braak is to be congratulated on the thoroughness and completeness of the work. Java is not a very large island, being only 600 miles long by 40 to 120 wide, but the amount of material available was so great that even in a volume of this size (the Dutch text alone runs to 243 pages) it was impossible to use all the stations. As in previous parts, there is a very full English summary, almost a translation, running to 116 pages, with references to the tables in the Dutch text. The style of the English is a testimonial to the author's linguistic ability, and the following passage shows its vigour and attractiveness:—

"Another phenomenon of the dry season is the haze, which covers the blue sky with a whitish tint, obstructs the view and envelopes the distant mountains in a bluish veil or makes them invisible, obliterating at the same time the fresh colours of the landscape. Who wants to see Java at its best and is not afraid of a bit of rain should see it in the west monsoon, or better still, in the months following it, before the really dry season, when the transparent air gives full credit to the colour effects of the luxurious landscape."

The volume opens with a description of the monsoons and

local winds, but for the most part the treatment is particular, the generalisations having been set out in the first volume. The islands are divided up into a number of sections or representative stations—Batavia, Buitenzorg, Mount Gedeh-Pangerango, &c., and the climate of each is set out in detail, with a wealth of tables. The section dealing with the Royal Observatory at Batavia is naturally the most complete, covering 25 pages, with no fewer than 18 tables showing the annual and diurnal variations of the means and extremes—a mine of reference. A curious diagram facing page 196 shows that temperature at Batavia has a rough periodicity of eleven years, being high at sunspot minimum and low at sunspot maximum. This cyclic variation is, however, dominated by a remarkable secular rise, as a result of which the coldest year since 1895 has been warmer than the warmest year before 1895. The author states that the cause of this rise of temperature is unknown. A similar rise has been in progress at St. Helena, and (until the present year) in the winter temperature of western Europe, and it seems probable that all three are to be attributed to some slow change in the general circulation.

The tables are amplified by the frequent reproductions of thermograms and hygrograms, which are of very great interest. Incidentally one wonders whether the inclusion on page 221 of a hygrogram from the summit of Mount Pangerango was due to a sense of humour or to the absence of such a sense, coupled with a desire for completeness. The humidity curve is a straight horizontal line at 100 per cent. These mountain stations, at heights up to 10,000ft., are an important part of the network, and are very thoroughly equipped.

In addition to the meteorograms, the work is illustrated by a number of very fine photographs. A series of notable interest is that facing page 275, taken from a high level station at intervals from 7 a.m. to 9 a.m., which shows the gradual break up of a sheet of fog in the valley beneath, and the simultaneous formation of cumulus clouds above the surrounding mountains. Details of this nature, possibly only to the man on the spot, clothe the dry bones of meteorological statistics with living flesh, and instil them with the breath of life.

Part 3 completes the second volume of Dr. Braak's excellent treatise on the climate of the Dutch East Indies, the area described including Borneo, the smaller islands eastward thereof and part of New Guinea. For the scattered islands the observational material is less complete and is supplemented by ships' observations and by information from the sailing directions; the result is a remarkably detailed account of the climate of the region in question.

Indexes to the Dutch and English parts of Vol. II are included. These are very complete, " local winds," for example, giving

some twenty entries, several of which refer to winds of föhn type. An interesting effect of the föhn appears in the results of pilot balloon ascents at Koepang. There the assumption of a constant rate of ascent leads to abnormally high wind velocities up to about 3,000 feet during the east monsoon, the balloons being "pulled down by the descending movement of the wind." The wind circulation at the surface during the monsoons is illustrated on a map of the area large enough to be really useful.

Some of the mountain peaks of New Guinea rise to a height of over 15,000 feet, "the eternal snow, though an attractive and remarkable phenomenon in a tropical country, covers a very small area only."

Dr. Braak's work may be regarded as indispensable in any study of equatorial climate.

Books Received

Observations des Stations Météorologiques du Réseau de l'Observatoire Geophysique à l'Orient Lointain. Année 1916. Vladivostok, 1928.

Résumés mensuels et annuels des Observations Météorologiques faites aux Stations de 11 *ordre du Réseau de l'Observatoire Geophysique à l'Orient Lointain.* Année 1917. Vladivostok, 1928.

Obituary

We regret to learn of the death of Cav. Prof. Ludovico Marini on October 6th, 1929, after a long illness. He was professor of terrestrial physics at the Universities of Rome and Naples and had published many valuable papers on the climatology of the Mediterranean, among which may be mentioned Charts of pressure and winds over the Mediterranean Basin and Climatic Notes on the principal coastal towns of the Adriatic.

We regret to learn of the death of Professor Polis, director of the Meteorological Observatory at Aachen.

We regret to learn of the death on October 9th at Iombar, Guildford, of Mr. Elliott Kitchener, formerly of Rugby and of the Golden Parsonage Preparatory School, aged 63 years.

The Weather of October, 1929

The weather of October was mainly unsettled with rainfall above normal except in the eastern districts and sunshine above normal except in the extreme west. Pressure, too, was below normal over the whole country, the deficit amounting to 9.0mb. at Aberdeen and 3.4mb. at Kew. The month opened with a 9-day

spell of generally unsettled stormy weather; rain fell on most days, but there were many bright intervals, for example, Aberdeen had 9.9hrs. bright sunshine on the 2nd, Durham 9.9hrs. on the 3rd and Cork 9.6hrs. on the 6th. Gales occurred in Scotland and Ireland on the 2nd and 3rd and in England on the 5th and 6th, when the rainfall was unusually heavy; 4·00 in. fell at Goytre (Monmouth), 3·81 in. at Holne (Devon), and 3·56 at Wheddon Cross (Somerset) on the 5th. A further moderately heavy rainfall with a southerly gale occurred in the south on the night of the 7th-8th. Thunderstorms were reported from numerous places over the country generally on the 2nd to 6th and from southern England on the 8th. From the 9th to 17th an anticyclone to the south of the British Isles brought fairer weather to the southern districts generally and also on a few days to the north and west as well although these areas remained chiefly under the influence of depressions centred further north. Many hours' bright sunshine was recorded on the 11th and 14th over the country generally, but rainfall was heavy in Ireland on the 10th and in Scotland on the 13th and 16th. During the first half of the month temperature was somewhat above normal for that period maxima ranging between 55°F. and 65°F., while 67° was recorded at Greenwich on the 16th. On the 18th, however, in the rear of a depression moving east there was a sharp fall of temperature and hereafter maxima were generally below 60°F. and even fell to 41°F. at Inverness, Fort Augustus and Stonyhurst on the 25th. Minimum temperatures on the ground fell to 20°F. and below at several places on the 19th and 25th-27th, 12°F. being reached at Burnley on the 26th and 27th. On the 20th and 21st a deep depression moved south over the country giving rain generally and northwesterly gales on our western coasts. At Scilly force 9 (49m.p.h.) was registered at 1h. on the 21st. This was followed by an interval of fair to fine weather but on the evening of the 23rd and on the 24th moderate rain again occurred over the kingdom generally and gales were experienced at most exposed places in southern England. Thunderstorms were reported from various parts of England on the 25th and snow was seen on the hills above 800ft. locally in Scotland. For the rest of the month the weather was unsettled with bright intervals.

Pressure was below normal over the whole of northern and western Europe, Spitsbergen and Iceland, the greatest deficits being 9·8mb. at Aberdeen and Utsire (Norway), and above normal over most of the North Atlantic, the Iberian Peninsula and southern Italy, the greatest excess being 5·2mb. at Horta. Temperature was above normal generally and rainfall below normal except in parts of Sweden and of the British Isles. In central Sweden the rainfall was twice the normal.

Heavy rain occurred in Switzerland on the 5th, heavy gales in western Norway on the 6th and gales and heavy rain followed by local floods in France on the 6th. On the same day, after six weeks of fine weather a cloudburst was reported from the Italian Riviera where there were several landslides; parts of Savona were flooded. Bad weather continued throughout Italy the next day when the neighbourhood of Genoa and parts of Sardinia were flooded. Heavy rain fell in Switzerland on the 9th and 10th causing the rivers to rise and extinguishing the forest fires on the Calanda. Snow fell on the Little and Great St. Bernard passes on the 8th and on the Alpine regions of Switzerland generally on the 10th. In consequence of a storm in the eastern Baltic the river Neva overflowed its banks at Leningrad on the 15th and much damage has resulted. Thunderstorms occurred on the Riviera on the 18th and in various parts of France on the 19th and 20th and a heavy fall of snow was reported from the Vosges on the 21st. A severe gale swept across the Gulf of Genoa on the 26th and storms were experienced off north-west France on the 26th and 27th. Gales were experienced near Salonika on the 30th.

A violent storm struck the suburbs of Turffontein and Kenilworth (South Africa) on the 6th. Three people were seriously injured and the roofs were blown off hundreds of houses.

Storms were experienced in Western Australia on the 5th.

Severe gales occurred on the Great Lakes on the 21st-22nd and on the 29th and dense fog on the 30th. Blizzards swept across New Mexico and Arizona on the 28th-29th. Temperature was generally below normal over the United States during the first fortnight but after this it rose above normal. Heavy rain occurred in the Atlantic States during the first week, in the Mississippi-Missouri region during the second and in the south Atlantic States during the third week. The river Uruguay flood interrupted train services between Buenos Aires and Asuncion on the 23rd.

The special message from Brazil states that the rainfall was scarce in the northern regions with 0·20in. below normal, very scarce in the central regions with 2·13in. below normal, while the distribution was irregular in the southern regions with 0·16in. below normal. Seven anticyclones passed across the country. Crops were generally in good condition except for the cane and tobacco crops of some regions which were suffering from lack of rain. At Rio de Janeiro pressure was 0·6mb. below normal and temperature 2·9°F. above normal.

Rainfall, October, 1929.—General Distribution

England and Wales	120	per cent. of the average 1881-1915.
Scotland	144	
Ireland	127	
British Isles	128	

Rainfall: October, 1929: England and Wales

Co.	Station	In.	Per-cent of Av.	Co.	Station	In.	Per-cent. of Av.
Lond .	Camden Square	2·72	103	*Leics* .	Belvoir Castle	2·70	100
Sur .	Reigate, Alvington	3·71	...	*Rut* .	Ridlington	3·15	...
Kent .	Tenterden, Ashenden	3·28	94	*Linc* .	Boston, Skirbeck	2·70	98
,, .	Folkestone, Boro. San.	3·92	...	,, .	Lincoln	2·59	101
,, .	Margate, Cliftonville	2·83	97	,, .	Skegness, Marine Gdns	2·29	84
,, .	Sevenoaks, Speldhurst	3·36	...	,, .	Louth, Westgate	2·73	84
Sus .	Patching Farm	4·90	124	,, .	Brigg, Wrawby St.	3·56	...
,, .	Brighton, Old Steyne	3·41	88	*Notts* .	Worksop, Hodsock	3·07	117
,, .	Heathfield, Barklye	4·69	113	*Derby* .	Derby, L. M. & S. Rly.	3·06	117
Hants .	Ventnor, Roy. Nat. Hos.	5·56	141	,, .	Buxton, Devon Hos.	6·59	134
,, .	Fordingbridge, Oaklnds	5·15	124	*Ches* .	Runcorn, Weston Pt.	5·21	151
,, .	Ovington Rectory	...	...	,, .	Nantwich, Dorfold Hall	5·87	...
,, .	Sherborne St. John	3·45	98	*Lancs* .	Manchester, Whit. Pk.	5·17	157
Berks .	Wellington College	2·50	76	,, .	Stonyhurst College	6·74	150
,, .	Newbury, Greenham	3·26	93	,, .	Southport, Hesketh Pk	4·52	128
Herts .	Welwyn Garden City	2·52	...	,, .	Lancaster, Strathspey	6·10	...
Bucks .	High Wycombe	3·95	126	*Yorks* .	Wath-upon-Dearne	2·40	87
Oxf .	Oxford, Mag. College	2·97	106	,, .	Bradford, Lister Pk.	3·63	104
Nor .	Pitsford, Sedgebrook	2·98	111	,, .	Oughtershaw Hall	9·81	...
,, .	Oundle	2·37	...	,, .	Wetherby, Ribston H.	2·21	74
Beds .	Woburn, Crawley Mill	3·19	119	,, .	Hull, Pearson Park	2·10	70
Cam .	Cambridge, Bot. Gdns.	2·83	120	,, .	Holme-on-Spalding	2·56	...
Essex .	Chelmsford, County Lab	3·47	141	,, .	West Witton, Ivy Ho.	4·38	...
,, .	Lexden Hill House	2·67	...	,, .	Felixkirk, Mt. St. John	2·73	95
Suff .	Hawkedon Rectory	2·89	107	,, .	Pickering, Hungate	2·36	...
,, .	Haughley House	2·67	...	,, .	Scarborough	1·82	58
Norf .	Norwich, Eaton	3·19	102	,, .	Middlesbrough	2·22	74
,, .	Wells, Holkham Hall	...	...	,, .	Baldersdale, Hury Res.	...	...
,, .	Little Dunham	3·43	110	*Durh* .	Ushaw College	2·02	59
Wilts .	Devizes, Highclere	4·30	138	*Nor* .	Newcastle, Town Moor	1·73	54
,, .	Bishops Cannings	4·61	139	,, .	Bellingham, Highgreen	3·73	...
Dor .	Evershot, Melbury Ho.	6·35	137	,, .	Lilburn Tower Gdns.	2·78	...
,, .	Creech Grange	4·85	...	*Cumb* .	Geltsdale	5·69	...
,, .	Shaftesbury, Abbey Ho.	4·38	112	,, .	Carlisle, Scaleby Hall	4·50	135
Devon .	Plymouth, The Hoe	5·93	150	,, .	Borrowdale, Seathwaite	18·25	152
,, .	Polapit Tamar	7·91	165	,, .	Borrowdale, Rosthwaite	13·57	...
,, .	Ashburton, Druid Ho.	8·48	140	,, .	Keswick, High Hill	7·53	...
,, .	Cullompton	5·92	143	*Glam* .	Cardiff, Ely P. Stn.	6·32	132
,, .	Sidmouth, Sidmount	4·37	117	,, .	Treherbert, Tynywaun	13·72	...
,, .	Filleigh, Castle Hill	7·99	...	*Carm* .	Carmarthen Friary	8·04	141
,, .	Barnstaple N. Dev. Ath.	6·49	143	,, .	Llanwrda	9·01	142
Corn .	Redruth, Trewirgie	8·65	165	*Pemb* .	Haverfordwest, School	6·96	129
,, .	Penzance, Morrab Gdn.	7·16	153	*Card* .	Aberystwyth	7·72	...
,, .	St. Austell, Trevarna	8·70	165	,, .	Cardigan, County Sch.	6·65	...
Soms .	Chewton Mendip	7·96	165	*Brec* .	Crickhowell, Talymaes	7·30	...
,, .	Long Ashton	6·76	...	*Rad* .	Birm W. W. Tyrmynydd	8·62	130
,, .	Street, Millfield	4·70	...	*Mont* .	Lake Vyrnwy	7·92	137
Glos. .	Cirencester, Gwynfa	4·40	133	*Denb* .	Llangynhafal	4·49	...
Here .	Ross, Birchlea	4·83	146	*Mer* .	Dolgelly, Bryntirion	10·18	194
,, .	Ledbury, Underdown	4·21	137	*Carn* .	Llandudno	4·19	117
Salop .	Church Stretton	4·04	111	,, .	Snowdon, L. Llydaw 9	23·05	...
,, .	Shifnal, Hatton Grange	3·66	129	*Ang* .	Holyhead, Salt Island	6·16	154
Worc .	Ombersley, Holt Lock	3·67	137	,, .	Lligwy	4·69	...
,, .	Blockley	4·08	..	*Isle of Man*			
War .	Farnborough	3·14	99		Douglas, Boro' Cem.	7·73	170
,, .	Birminghm. Edgbaston	4·11	83	*Guernsey*			
Leics .	Thornton Reservoir	3·86	137		St. Peter P't. Grange Rd.	5·84	130

Rainfall: October, 1929: Scotland and Ireland

Co.	Station	In.	Per-cent of Av.	Co.	Station	In.	Per-cent of Av.
Wigt.	Stoneykirk, Ardwell Ho	5·47	151	*Suth.*	Loch More, Achfary	14·76	189
,,	Pt. William, Monreith	6·65	...	*Caith.*	Wick	4·41	149
Kirk.	Carsphairn, Shiel	10·26	...	*Ork.*	Pomona, Deerness	6·13	162
,,	Dumfries, Cargen	6·43	147	*Shet.*	Lerwick	8·70	220
Dumf.	Eskdalemuir Obs.	6·89	128	*Cork.*	Caheragh Rectory	6·35	...
Roxb.	Branxholm	3·66	113	,,	Dunmanway Rectory	5·82	97
Selk.	Ettrick Manse	...	...	,,	Ballinacurra	3·02	74
Peeb.	West Linton	4·56	...	,,	Glanmire, Lota Lo.	3·58	86
Berk.	Marchmont House	2·90	76	*Kerry.*	Valentia Obsy.	6·29	113
Hadd.	North Berwick Res.	2·25	76	,,	Gearahameen	11·30	...
Midl.	Edinburgh, Roy. Obs.	3·05	117	,,	Killarney Asylum	...	...
Ayr.	Kilmarnock, Agric. C.	5·07	144	,,	Darrynane Abbey	6·00	119
,,	Girvan, Pinmore	6·51	130	*Wat.*	Waterford, Brook Lo.	3·41	87
Renf.	Glasgow, Queen's Pk.	5·08	156	*Tip.*	Nenagh, Cas. Lough	5·63	166
,,	Greenock, Prospect H.	8·78	163	,,	Roscrea, Timoney Park	4·24	...
Bute.	Rothesay, Ardencraig	7·66	174	,,	Cashel, Ballinamona	3·60	100
,,	Dougarie Lodge	5·32	...	*Lim.*	Foynes, Coolnanes	5·15	136
Arg.	Ardgour House	16·24	...	,,	Castleconnel Rec.	5·02	...
,,	Manse of Glenorchy	13·05	...	*Clare.*	Inagh, Mount Callan	9·80	...
,,	Oban	8·95	...	,,	Broadford, Hurdlest'n.	5·68	...
,,	Poltalloch	8·53	173	*Wexf.*	Newtownbarry	...	...
,,	Inveraray Castle	12·65	180	,,	Gorey, Courtown Ho.	3·37	95
,,	Islay, Eallabus	9·21	193	*Kilk.*	Kilkenny Castle	3·05	97
,,	Mull, Benmore	12·50	...	*Wic.*	Rathnew, Clonmannon	2·45	...
,,	Tiree	7·05	...	*Carl.*	Hacketstown Rectory	3·88	102
Kinr.	Loch Leven Sluice	3·75	109	*Leix.*	Blandsfort House	4·05	115
Perth.	Loch Dhu	10·00	140	,,	Mountmellick	4·87	...
,,	Balquhidder, Stronvar	8·77	...	*Off'ly.*	Birr Castle	4·06	139
,,	Crieff, Strathearn Hyd.	5·37	137	*Dubl.*	Dublin, FitzWm. Sq.	2·38	89
,,	Blair Castle Gardens	4·17	134	,,	Balbriggan, Ardgillan.	2·85	106
,,	Dalnaspidal Lodge	10·29	180	*Me'th.*	Beauparc, St. Cloud	3·29	...
Angus.	Kettins School	3·73	131	,,	Kells, Headfort	4·69	140
,,	Dundee, E. Necropolis	2·86	107	*W.M.*	Moate, Coolatore	4·40	...
,,	Pearsie House	3·85	...	,,	Mullingar, Belvedere	5·21	167
,,	Montrose, Sunnyside	2·73	99	*Long.*	Castle Forbes Gdns.	4·76	146
Aber.	Braemar, Bank	3·72	99	*Gal.*	Ballynahinch Castle	7·68	128
,,	Logie Coldstone Sch.	2·34	72	,,	Galway, Grammar Sch.	5·30	...
,,	Aberdeen, King's Coll.	3·20	107	*Mayo.*	Mallaranny	3·88	...
,,	Fyvie Castle	4·41	...	,,	Westport House	5·07	113
Moray.	Gordon Castle	3·49	110	,,	Delphi Lodge	11·94	...
,,	Grantown-on-Spey	4·30	145	*Sligo.*	Markree Obsy.	5·67	138
Nairn.	Nairn, Delnies	3·41	145	*Cav'n.*	Belturbet, Cloverhill	5·40	186
Inv.	Kingussie, The Birches	4·89	...	*Ferm.*	Enniskillen, Portora	4·36	...
,,	Loch Quoich, Loan	...	...	*Arm.*	Armagh Obsy	5·55	202
,,	Glenquoich	23·84	239	*Down.*	Fofanny Reservoir	6·74	...
,,	Inverness, Culduthel R.	3·55	...	,,	Seaforde	3·84	108
,,	Arisaig, Faire-na-Squir	9·21	...	,,	Donaghadee, C. Stn.	3·45	119
,,	Fort William	13·97	...	,,	Banbridge, Milltown	2·89	...
,,	Skye, Dunvegan	9·80	...	*Antr.*	Belfast, Cavehill Rd.	4·86	...
R & C.	Alness, Ardross Cas.	4·87	126	,,	Glenarm Castle	6·23	...
,,	Ullapool	8·17	...	,,	Ballymena, Harryville	6·75	183
,,	Torridon, Bendamph.	13·86	173	*Lon.*	Londonderry, Creggan	5·55	151
,,	Achnashellach	16·02	...	*Tyr.*	Donaghmore	6·96	...
,,	Stornoway	7·61	147	,,	Omagh, Edenfel	6·00	163
Suth.	Lairg	4·78	...	*Don.*	Malin Head	5·18	...
,,	Tongue	7·04	167	,,	Dunfanaghy	4·64	...
,,	Melvich	8·26	222	,,	Killybegs, Rockmount.	7·95	142

Climatological Table for the British Empire, May, 1929.

STATIONS	PRESSURE: Mean of Day M.S.L.	PRESSURE: Diff. from Normal	TEMPERATURE: Absolute: Max.	TEMPERATURE: Absolute: Min.	TEMPERATURE: Mean Values: Max.	TEMPERATURE: Mean Values: Min.	TEMPERATURE: Mean Values: ½ max. and min.	TEMPERATURE: Mean Values: Diff. from Normal	TEMPERATURE: Mean: Wet Bulb	Relative Humidity.	Mean Cloud Am'nt	PRECIPITATION: Am'nt	PRECIPITATION: Diff. from Normal	PRECIPITATION: Days	BRIGHT SUNSHINE: Hours per day	BRIGHT SUNSHINE: Per-cent-age of possi-ble
	mb.	mb.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%	0—10	in.	in.			
London, Kew Obsy	1015·9	0·0	81	31	63·1	45·0	54·1	+ 0·7	47·0	80	5·9	1·27	− 0·45	11	7·9	50
Gibraltar	1016·9	+ 0·8	80	45	72·8	56·2	64·5	− 1·0	54·9	76	3·5	0·18	− 1·55	3	..	..
Malta	1013·4	− 1·6	84	54	69·6	60·0	64·8	− 1·1	60·0	78	4·0	0·30	− 0·11	1	10·1	72
St. Helena	1013·3	+ 2·1	67	56	63·8	58·1	60·9	− 2·7	60·4	97	8·3	3·11	− 1·04	15	..	..
Sierra Leone	1011·2	0·0	90	70	86·8	74·3	80·5	− 1·0	77·3	82	3·3	8·44	− 3·03	19	..	..
Lagos, Nigeria	1012·1	+ 1·1	89	70	86·0	76·0	81·0	− 0·8	77·3	83	8·3	10·78	+ 0·31	20	..	..
Kaduna, Nigeria	1013·7	+ 0·6	96	..	91·0	..	..	..	69·2	54	..	4·29	− 1·65	12	..	..
Zomba, Nyasaland	1015·0	− 0·1	84	50	75·9	56·0	65·9	+ 0·1	..	71	4·4	0·35	− 0·69	2	..	..
Salisbury, Rhodesia	1016·1	+ 0·3	83	43	74·6	48·4	61·5	+ 0·9	54·7	55	1·8	0·26	− 0·28	4	8·8	78
Cape Town	1018·4	+ 0·4	85	44	64·9	52·4	58·7	− 0·2	53·5	90	6·8	2·31	− 1·44	10	..	..
Johannesburg	1019·3	+ 0·3	75	38	66·4	48·5	57·5	+ 3·1	47·3	55	2·1	1·22	+ 0·46	4	9·1	83
Mauritius	1015·5	− 0·9	80	60	77·5	66·6	72·1	− 0·5	69·4	76	4·7	8·02	+ 4·99	19	7·3	65
Bloemfontein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Calcutta, Alipore Obsy.	1002·9	− 0·6	102	73	97·5	81·3	89·4	+ 3·4	81·0	79	5·2	1·54	− 4·21	4*	..	..
Bombay	1007·3	− 0·1	95	80	93·2	82·2	87·7	+ 1·8	79·1	73	3·5	0·00	− 0·55	0*	..	..
Madras	1004·8	− 0·6	108	75	99·4	81·8	90·6	+ 0·7	78·6	63	4·5	0·75	− 0·32	1*	..	..
Colombo, Ceylon	1009·2	+ 0·6	88	69	86·8	77·5	82·1	− 0·4	78·6	79	8·5	15·46	+ 2·78	23	5·0	40
Hongkong	1008·7	− 0·7	90	67	82·6	75·0	78·8	+ 1·4	74·9	82	8·4	6·62	− 4·98	17	5·0	38
Sandakan	..	..	90	73	88·4	75·6	82·0	− 0·6	78·3	83	..	13·31	+ 7·40	13	..	..
Sydney, N.S.W.	1018·4	− 0·2	80	47	66·3	51·8	59·1	+ 0·3	53·0	76	4·3	10·35	+ 5·22	13	6·1	58
Melbourne	1019·2	− 0·3	72	36	62·0	46·3	54·1	0·0	49·3	79	7·2	1·85	− 0·33	18	4·5	45
Adelaide	1020·0	− 0·1	79	42	66·6	49·8	58·2	+ 0·3	50·4	58	6·3	1·40	− 1·36	14	4·7	46
Perth, W. Australia	1015·0	− 3·5	77	46	66·5	53·2	59·9	− 0·7	54·6	73	7·2	11·50	+ 6·56	22	4·4	42
Coolgardie	1016·7	− 3·1	87	41	66·3	48·5	57·4	− 0·2	51·2	70	5·6	2·84	+ 1·48	10	..	..
Brisbane	1018·4	− 0·4	82	47	72·6	53·0	62·8	− 1·7	55·8	65	3·2	0·42	− 2·41	4	8·2	77
Hobart, Tasmania	1017·1	+ 1·5	74	36	58·1	45·3	51·7	+ 1·3	46·1	75	6·4	1·58	− 0·28	14	4·3	44
Wellington, N.Z.	1019·2	+ 3·6	65	39	56·0	45·0	50·5	− 2·2	48·1	80	5·1	3·48	− 1·20	11	5·4	55
Suva, Fiji	1011·9	− 0·9	86	66	82·1	72·3	77·2	+ 0·7	73·7	80	6·4	6·84	− 3·32	17	3·9	35
Apia, Samoa	1010·5	− 0·6	89	69	85·5	74·2	79·8	+ 1·4	76·7	71	4·0	4·51	− 1·00	15	7·3	63
Kingston, Jamaica	1014·6	+ 1·5	89	68	87·3	71·5	79·4	− 0·3	70·9	77	4·9	0·63	− 3·76	7	5·1	39
Grenada, W.I.	1010·0	− 2·5	90	71	85·6	73·0	79·3	− 0·3	73·5	80	5·3	8·56	+ 3·97	24	..	..
Toronto	1016·6	+ 1·8	91	33	62·2	43·8	53·0	+ 0·3	46·0	60	5·0	3·77	+ 0·79	12	7·2	49
Winnipeg	1017·0	+ 2·7	83	22	59·0	36·4	47·7	− 3·9	..	..	6·0	2·69	+ 0·39	8	7·7	50
St. John, N.B.	1016·3	+ 2·3	68	33	56·4	40·8	48·6	+ 0·9	44·0	68	6·1	4·23	+ 0·52	16	6·7	45
Victoria, B.C.	1018·6	+ 2·2	71	42	58·9	45·6	52·3	− 0·8	48·7	81	5·8	0·95	− 0·35	8	8·9	59

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

St. John, N.B.	1016·3	+ 2·3	68	33	56·4	40·8	48·6	+ 0·9	44·0	68	6·1	4·23	+ 0·52	16	6·7	45
Victoria, B.C.	1018·6	+ 2·2	71	42	58·9	45·6	52·3	— 0·8	48·7	81	5·8	0·95	— 0·35	8	8·9	59

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.